Lloyd's Register

CERTIFICATE OF FIRE APPROVAL

This is to certify that

The product detailed below will be accepted for compliance with the applicable Lloyd's Register Rules and Regulations and with the International Convention for the Safety of Life at Sea, (SOLAS), 1974, as amended, for use on ships and offshore installations classed with Lloyd's Register, and for use on ships and offshore installations when authorised by contracting governments to issue the relevant certificates, licences, permits etc.

Manufacturer	Kidde - Fenwal Inc.
Address	400 Main Street Ashland MA 01721 United States of America (USA)
Type	**FIXED GAS FIRE EXTINGUISHING SYSTEM**
Description	Fixed Fire Extinguishing System – Type: "Kidde ECS ADS Series Marine System with 3M™ Novec™ 1230 Fire Protection Fluid" for Machinery Spaces of Category A and Cargo Pump Rooms equivalent to Fire Extinguishing Systems required by SOLAS 1974 as amended, Chapter II-2/10.5 and 10.9. In addition the system may be used in the cargo compressor and pump rooms of LNG and LPG carriers.
Specified Standard	IMO MSC/Circ. 848 as amended by MSC.1/Circ.1267 and MSC.1/Circ.1316

The attached Design Appraisal Document forms part of this certificate.
This certificate remains valid unless cancelled or revoked, provided the conditions in the attached Design Appraisal Document are complied with and the equipment remains satisfactory in service.

Date of issue	29 September 2015	Expiry date	28 September 2020
Certificate No.	SAS F150260	Signed	Fire & Safety, MTES Lloyd's Register EMEA
Sheet No	1 of 6	Name	M. Farrier Surveyor to Lloyd's Register EMEA A Member of the Lloyd's Register Group

Note:

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Lloyd's Register of any modification or changes to the equipment in order to obtain a valid Certificate.

Lloyd's Register EMEA
71 Fenchurch Street, London, EC3M 4BS
Telephone 020 7423 2416 Fax 020 7423 2053
Email med@lr.org

DESIGN APPRAISAL DOCUMENT

Date	Quote this reference on all future communications
29 September 2015	MTES/SFS/TA/MF/WP22085945

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS F150260

This Design Appraisal Document forms part of the Certificate.

APPROVAL DOCUMENTATION

Underwriters Laboratory of Canada, Test Report No. EX 4674, dated 1 February 2005 and Lloyd's Register witness report, dated 26 October 2004. Additional component testing in test report No. EX 4674 dated 1 November 2014. Additional new nozzle "tell-tale" testing report UL Project No.4786098741, File EX 4674, Edition 2, dated 25 July 2013.

FM Approvals, Norwood, USA, Report PI 3026502, dated 24 March 2006.

Kidde-Fenwal Inc. and U.S. Coast Guard. CRADA, No. 04-CRADA-RDC-001, dated 16 November 2004.

CONDITIONS OF CERTIFICATION

1. The National Authorities of the vessel concerned are to accept the use of NOVEC 1230 as being acceptable for compliance with The International Code for Fire Safety Systems (Fire Safety Systems Code), Chapter 1, paragraph 4 and Chapter 5, paragraph 2.5 at the design stage. Should the system be installed in the cargo compressor and/or pump rooms of LNG or LPG ships the National Authorities of the vessel concerned are to accept the use of NOVEC 1230 for this application. The manufacturers of the system are to advise, whoever they are contracted to, of this requirement at the earliest opportunity
2. If the system is to be of the modular type, i.e., with both the NOVEC 1230 cylinders and associated separate nitrogen cylinders distributed within the machinery space, the National Authorities are to accept the arrangements with due reference to the Fire Safety Systems Code, Chapter 5, paragraph 2.1.1.4 and MSC/Circular 848, paragraph 11 of the Annex, as amended by MSC.1/Circ 1267. All other requirements specified in the Fire Safety Systems Code, Chapter 5, as amended by later IMO revisions of the Code are to be applied at the system design stage
3. The computation of the discharge time for each application is to be produced by the Kidde Fenwal program "Flow Calculation Software Users Guide 06-237256-004" dated 2014 and is to be independently verified at the design stage**.** The system should be designed so that 95% of the extinguishing agent can be discharged in 10 seconds. The flow calculation program shall be applied for balanced systems where the storage temperature range is 0°C - 54°C
4. The quantity of Novec 1230 for the protected space is to be calculated at the minimum expected ambient temperature (which is to be no greater than zero degrees Celsius) with a minimum design concentration of 5.85%. The maximum concentration is not to exceed 10% (LOAEL Limit) at the maximum expected ambient temperature, (not less than 50 degrees Celsius). Other temperature ranges may be considered on a project by project basis, subject to agreement by the National Administration. Where the system is installed in the cargo compressor and/or pump rooms of a Liquefied Natural Gas carrier, the minimum design concentration of the extinguishing agent is to be 7.2% based on an operating temperature of 20 degrees Celsius and amended to reflect any lower operating temperature of the space

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5. Where the system is installed in the cargo compressor and/or pump rooms of a Liquefied Petroleum Gas carrier, the minimum design concentration of the extinguishing agent is to be 6.5% based on an operating temperature of 20 degrees Celsius and amended to reflect any lower operating temperature of the space
6. The design concentration is to be based on the net volume of the protected space, including the casing, the bilge and the volume of free air contained in air receivers that in the event of a fire, is released into the protected space. All objects that occupy volume in the protected space should be subtracted from the gross volume of the space. They include, but are not necessarily limited to: auxiliary machinery, boilers, condensers, evaporators, main engines, reduction gears, tanks and trunks
7. The discharge of NOVEC 1230 is to be evenly distributed over the protected space and the nozzle spacing is not to exceed 5 metres for a 360-degree (ADS 360) nozzle or 10 metres for a 180-degree (ADS 180) nozzle or equivalent nozzle coverage arrangement. The maximum nozzle vertical spacing is not to be greater than 5 metres
8. The pressure at each nozzle is to be a minimum of 5.5 bar, at a maximum cylinder fill density of 1121 kg/m^3, for nozzle types: ADS 360 and ADS 180. The drill sizes of each nozzle orifice, nozzle part numbers and the quantity of agent to be discharged from each nozzle is to be determined by the flow calculation program. Nozzles to be manufactured from ASTM B16 Brass or stainless steel
9. 10% of the distribution piping is to be pressure tested to 1.25 times the maximum pressure likely to be experienced in service. For NOVEC 1230 systems, this equates to 1.25 x 28 bar (at 54°C) = 35 bar.
10. For systems with NOVEC 1230 cylinders stored outside the protected space, with a manifold and distribution valve(s). The manifold pipework is to be tested to at least 1.5 times the setting of the manifold relief valve. The manifold relief valve is to be set at a minimum pressure of 35 bar and the minimum manifold test pressure is to be 53 bar. The NOVEC 1230 cylinders should be suitably designed to be pressure tested at least 1.5 times the pressure at the maximum temperature of the space in which they are stored, this equates to 1.5 x 28 bar (at 54°C) = 42 bar. The manufacturer pressure tests NOVEC 1230 cylinders at 69 bar for this system
11. The system also includes nitrogen cylinders at a nominal stored pressure of 124 bar at 21°C and up to 138.3 bar at 54°C, used to increase the discharge rate of the NOVEC 1230 liquid from their storage cylinder(s). The nitrogen cylinders should be suitably designed to be pressure tested at least 1.5 times the pressure at the maximum temperature of the space in which they are stored, this equates to 1.5 x 138.3 bar (at 54°C) = 208 bar. The manufacturer pressure tests Nitrogen cylinders at 232 bar for this system
12. All pipework and fittings should be of suitable galvanised steel or stainless steel construction. Threaded joints in fixed gas systems shall be allowed only inside protected spaces and in cylinder storage spaces
13. The arrangements and parts used in the system are to be in accordance with the Kidde ECS ADS Marine Series System document "Design, Installation, Operation and Maintenance Manual titled 'Kidde ECS ADS Marine Series System with 3M™ Novec™ 1230 Fire Protection Fluid", P/N 06-237257-001, dated July 2014. This manual also contains recommended procedures for the control of products of agent decomposition, including HF vapour generated from fluorocarbon extinguishing agents which could impair escape

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14. The means of control of the fixed gas fire-extinguishing system shall be readily accessible, simple to operate, and shall be grouped together in as few locations as possible at positions not likely to be cut off by a fire in a protected space. At each location there shall be clear instructions relating to the operation of the system having regard to the safety of personnel
15. Where agent containers are stored within a protected space, the containers should be evenly distributed throughout the space and the arrangement of containers and the electrical circuits and piping essential for the release of any system should be such that in the event of damage to any one power release line or container valve through mechanical damage, fire or explosion in a protected space, i.e. a single fault concept, at least the amount of agent needed to achieve the minimum extinguishing concentration can still be discharged having regard to the requirement for uniform distribution of medium throughout the space; and the containers should be monitored for decrease in pressure due to leakage and discharge. Visual and audible alarms in the protected area and on the navigation bridge or in the space where the fire control equipment is centralised should be provided to indicate this condition
16. Arrangement drawings and calculations are to be submitted for acceptance in each case where it is proposed to install this system. Control panel schematics are also to be submitted. All principle components of the system are to be identified and their location indicated
17. Suitable warning of the possible products of agent decomposition is to be posted at the release station and personnel advised not to enter the space without breathing apparatus and protective clothing until the space has been thoroughly ventilated. Warning should also be posted to say that the integrity of the space is to be maintained after release of the agent and that the products of decomposition and combustion are not to be vented into areas where personnel could be present
18. Production items are to be manufactured in accordance with a quality control system which shall be maintained to ensure that items are of the same standard as the approved prototype

GENERAL NOTES

1. The system is to be designed in accordance with the Annex of IMO MSC/Circ. 848 as amended by MSC.1/Circ. 1267 and MSC.1/Circ.1316. In particular, revised requirements apply where agent containers are stored within a protected space
2. All systems should be designed to allow evacuation of the protected spaces prior to discharge. Means should also be provided for automatically giving audible and visual warning of the release of the fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarm should operate for the period of time necessary to evacuate the space, but not less than 20 seconds before the medium is released. Unnecessary exposure, even at concentrations below an adverse effect level, should be avoided
3. Even at concentrations below an adverse effect level, exposure to gaseous fire extinguishing agents should not exceed 5 minutes. If a halocarbon agent is to be used above its NOAEL, means should be provided to limit exposure to no longer than the time specified according to a scientifically accepted physiologically based pharmacokinetic (PBPK) model or its equivalent which clearly establishes safe exposure limits both in terms of extinguishing media concentration and human exposure time

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4. The mechanical ventilation of the protected space(s) must be stopped before the activation of the fixed gas system and compartment closure arrangements should be designed to provide an agent hold time of at least 15 minutes. The release of an extinguishing agent may produce significant over and under pressurisation in the protected space. Measures to limit the induced pressures to acceptable limits should be provided
5. The system should be supplied by both main and emergency sources of power, with the emergency power supply being provided from outside the protected machinery space.
6. The system pipe work including; pipes, valves and fittings are to be in accordance with the requirements of the approval authority
7. The system storage containers and associated pressure components are to be designed and tested to codes of practice recognised by the approval authority, indicating that they can withstand the pressure expected in service, having regard to their installed location and that they are suitable for the agent identified
8. Recommended procedures for the control of products of agent decomposition are to be provided. In particular, on passenger ships, the decomposition products should not be discharged in the vicinity of muster (assembly) stations
9. Provisions should also be made to ensure that escape routes which may be exposed to leakage from the protected space are not rendered hazardous during or after discharge of the agent. Control Stations and other locations that require manning during a fire situation should have provisions to keep HF and HCl below 5 ppm at that location. The concentrations of other products should be kept below concentrations considered hazardous for the required duration of exposure
10. As longer exposure of the agent to high temperatures would produce greater concentrations of HF and HCl gases, the type and sensitivity of detection, coupled with the rate of discharge, should be selected to minimise the exposure time of the agent to the elevated temperature. The performance of fire-extinguishing arrangements on passenger ships should not present health hazards from decomposed extinguishing agents, for example on passenger ships, the decomposition products should not be discharged in the vicinity of muster (assembly) stations. Other mitigating steps include evacuation and donning masks
11. Warning signs should be located outside each entry to the protected space(s)
12. Suitable means of checking storage cylinder pressure and weight to be provided
13. Installation onboard: The on board arrangements and installation of this system are not part of this design Appraisal or certificate. All such arrangements are to be to the satisfaction of the Surveyors attending on board. On completion of the installation final acceptance of the system is dependent on satisfactory survey

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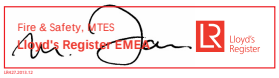
PLACE OF PRODUCTION

Kidde Products Limited
Station Road
High Bentham
Lancaster
LA2 7NA
United Kingdom

Kidde-Fenwal Inc.
400 Main St
Ashland
MA 01721
United States of America



Martin Farrier
Lead Specialist
Statutory Fire & Safety
Marine Technology and Engineering Services
Lloyd's Register EMEA

Supplementary Type Approval Terms and Conditions

This certificate and Design Appraisal Document relates to type approval, it certifies that the prototype(s) of the product(s) referred to herein has/have been found to meet the applicable design criteria for the use specified herein, it does not mean or imply approval for any other use, nor approval of any products designed or manufactured otherwise than in strict conformity with the said prototype(s).